

A NEW FROG (GENUS *ELEUTHERODACTYLUS*) FROM CLOUD FORESTS OF SOUTHERN BOYACA

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Resumen

Lynch, J. D.: A new frog (genus *Eleutherodactylus*) from cloud forests of southern Boyaca. Rev. Acad. Colomb. Cienc. 22 (84): 429-432, 1998. ISSN 0370-3908.

Se describe una especie nueva del género *Eleutherodactylus* con base en material de una localidad en el sur del Departamento de Boyacá. La especie nueva es la especie hermana de *E. nervicus*, conocida de los páramos asociados con Laguna Chingaza en el Departamento de Cundinamarca. La especie nueva es más grande que *E. nervicus* y tiene discos más grandes.

Palabras claves: Anura, cambio ecológico, especiación alopátrica, Leptodactylidae

Abstract

A new species of *Eleutherodactylus* is described from a single locality in southern Boyacá. It is the sister species of *E. nervicus*, known from the páramos associated with Laguna Chingaza in Departamento Cundinamarca. The new species is larger than *E. nervicus* and has larger digital disks.

Key words: Anura, allopatric speciation, ecological shift, Leptodactylidae

Introduction

In 1981, long before I would come to appreciate Boyacá and its cultural contributions to Colombia, my colleagues Ma. Cristina Ardila and Pedro M. Ruiz set out on an expedition to collect frogs from several of the páramos in northern Depto. Cundinamarca and

southern Boyacá. They were trying to define the southern limits of distribution of frogs of the genus *Phrynobatrachus* in the Cordillera Oriental and the collections of *Eleutherodactylus* made during that field trip remained unexamined until 1998. Most of the *Eleutherodactylus* that they collected pertained to the group including *E. bogotensis* and *E. lynchii* but one collection made on a cloud enshrouded cuchilla SE of Ramiriquí, Boyacá contained a small series of a strikingly different species.

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Lynch (1994) described *E. nervicus* from Alto del Tigre on the border between Deptos. Cundimarca and Meta. During the past few years, additional material has accumulated providing evidence that the species is not restricted to the Alto del Tigre as thought originally but is distributed across the complex of paramos collectively called Chingaza (Fig. 1). The frog from Ramiriquí appears to be the sister species of *E. nervicus*. These two species share a pointed snout, the tip of which develops a pale protuberance in adults. The protuberance appears to be formed partly by glandular development of the skin and partly by a core of connective tissue beneath the skin. This feature is here proposed as a synapomorphy of the pair of taxa.

Materials and methods

Terminology follows Lynch & Duellman, 1997. The following abbreviations are used in the text: E-N (distance from eye to nostril), HW (greatest head width), IOD (interorbital diameter), SVL (snout-vent length). Means are reported as \pm one SE of the mean when sample sizes are adequate.

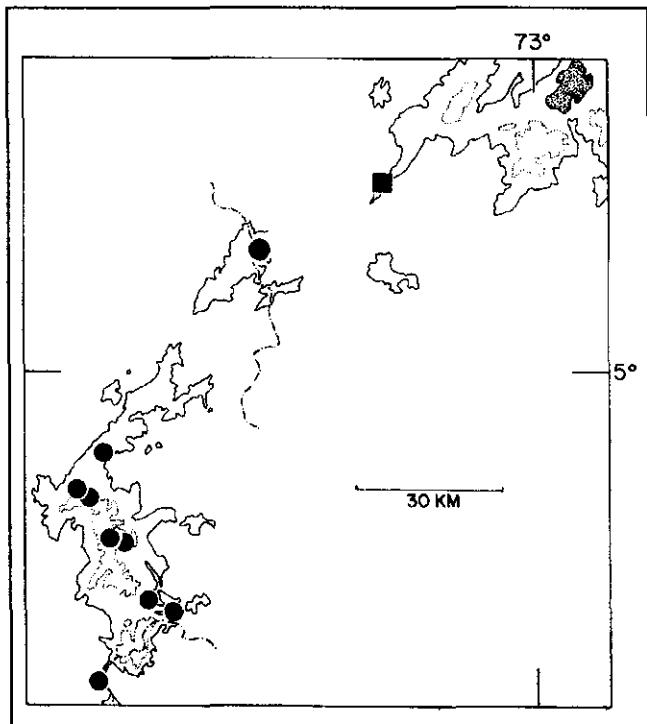


Figure 1. Distributions of *Eleutherodactylus mnionaeetes* sp. nov. (square) and *E. nervicus* (circles) on the Cordillera Oriental. 3000 m (solid lines) and 3600 m (dotted lines) contour lines serve to define páramo islands in the region. Lago Tota is shown in stipple.

Eleutherodactylus mnionaeetes sp. nov. (Fig. 2)

Holotype. ICN (amphibian collection of the Instituto de Ciencias Naturales, Universidad Nacional de Colombia) 11004, an adult female, one of a series collected by M. C. Ardila and P. M. Ruiz on 29 November 1981 (original field number PR 6203).

Type-locality. COLOMBIA, Departamento de Boyacá, municipio de Ramiriquí, Km 11-12 carretera Ramiriquí – Zetaquira, 3060-3080 m.

Paratopotypes. ICN 11005 (amplectant male), 11009-14 (other males), 11006-07 (adult females), taken with the holotype.

Referred specimen. ICN 11008, a juvenile female taken with the type-series.

Etymology. Greek (*mnios*, meaning moss, and *naetes*, meaning frequenting), in reference to the moss-encrusted microhabitat of the animal.

Diagnosis. (1) skin of dorsum bearing numerous low warts, that of venter areolate; dorsolateral folds extending about 1/2 length of body; (2) tympanum round, 30-44 % eye length; (3) snout acuminate in dorsal view,

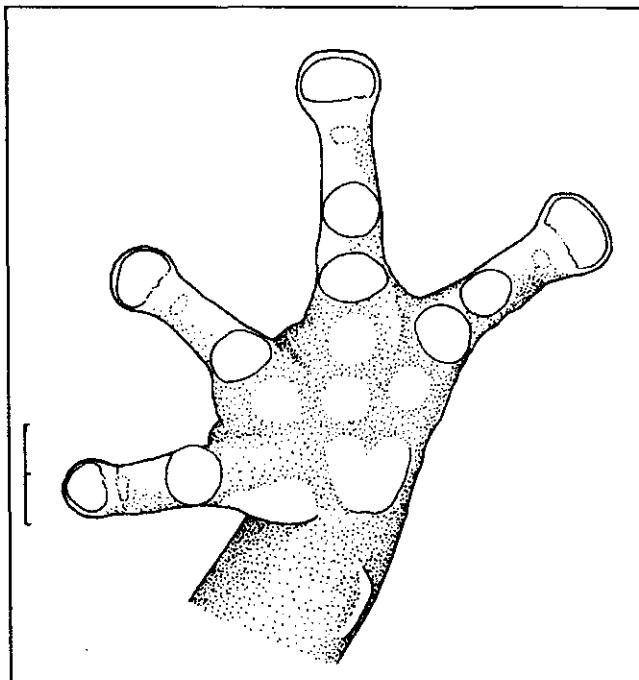


Figure 2. Palmar view of hand of *Eleutherodactylus mnionaeetes* sp. nov. (ICN 11007). Scale equals 2 mm.

pointed in lateral profile; canthus rostralis sharp, concave; (4) upper eyelid narrower than IOD; no cranial crests; (5) vomerine odontophores low; (6) males with vocal slits, subgular vocal sac, white, nuptial pads; (7) first finger slightly shorter than second; digits bearing slightly expanded disks; (8) fingers bearing thick lateral keels; (9) series of ulnar tubercles present; (10) low round tubercles on heel, short inner tarsal fold; (11) two metatarsal tubercles, inner oval, 4 times size of round outer; supernumerary plantar tubercles present; (12) toes bearing thick lateral fringes, producing basal webbing between outer toes, slightly expanded disks; fifth toe much longer than third; (13) dorsum brown with black markings; venter cream with brown reticulum or spots or brown with darker brown mottling; (14) adults small, males 17.9-20.8 ($\bar{x} = 19.4 \pm 0.4$, N = 7) mm SVL, 3 females 30.1-33.5 ($\bar{x} = 31.9$) mm SVL.

Most similar to *E. nervicus* from which it differs in having a more pointed snout, ulnar tubercles, larger digital disks, basal webbing between toes III-IV, more coarse skin of the dorsum, and nuptial pads in males. *Eleutherodactylus nervicus* (males 15.8-19.7 mm SVL, $\bar{x} = 17.1 \pm 0.3$, N = 14; females 23.9-28.2 mm SVL, $\bar{x} = 25.6 \pm 0.4$, N = 14) is also slightly smaller than *E. minionaetes*.

Description (proportions are based on seven males and four females). Head narrower than body, wider than long; HW 38.0-41.3 ($\bar{x} = 39.8 \pm 0.5$) % SVL in males, 39.5-41.7 ($\bar{x} = 40.6$) % in females; snout acuminate in dorsal view, nearly pointed in lateral profile; nostrils well back from tip of snout, weakly protuberant, directed laterally; E-N 66.7-78.3 ($\bar{x} = 71.8 \pm 1.5$) % eye length in males, 72.0-90.3 ($\bar{x} = 82.4$) % in females; canthus rostralis, sharp, gently curved; loreal region concave, sloping abruptly to lips; lips not flared; upper eyelids bearing low tubercles, narrower than interorbital space, their width 55.6-65.5 ($\bar{x} = 60.8 \pm 1.4$) % IOD in males, 55.6-62.1 ($\bar{x} = 59.7$) % in females; no cranial crests; supratympanic fold prominent, ending above insertion of upper arm; tympanum round, its length 30.4-37.5 ($\bar{x} = 34.3 \pm 0.8$) % eye length in males, 32.0-43.8 ($\bar{x} = 41.7$) % in females, separated from eye by distance equal its own diameter; two postorbital tubercles posteroventral to tympanum; choanae small, round, medial to palatal shelf of maxillary arch; odontophores median and posterior to choanae, each oval, bearing clump of 2-4 teeth, about 3-4 times size of a choana, separated medially by distance twice width of an odontophore; tongue longer than wide, its posterior 2/5 not adherent to floor of mouth, posterior border not notched; vocal slits posterolateral to tongue, short.

Series of low ulnar tubercles; palmar tubercle bifid, much larger than oval thenar; numerous low supernumerary palmar tubercles; subarticular tubercles round, nonconical; fingers bearing fleshy fringes (keels); all fingers with obvious round disks, those on outer digits larger than those on inner digits; disks about 1.5 times width of digit just proximal to disk; circumferential grooves complete, defining ventral pads (wider than long); first finger shorter than second; males with white nuptial pads.

Dorsum bearing many low warts, those on lower back coarsest; short dorsolateral fold, complete to level of sacrum, then continuing as series of larger warts (than those of back); a second fold on upper flank; no anal sheath or perianal tubercles (aside from warts on back); skin of flanks much more areolate than that of dorsum; venter areolate, discoidal folds well anteriad to groin; skin of upper surfaces of limbs less warty than dorsum.

Small tubercles on heel with even less distinct tubercles along outer edge of tarsus; inner edge of tarsus bearing short thickened fold on distal 1/5; inner metatarsal tubercle twice as long as wide, about 4 times size of round outer metatarsal tubercle; numerous supernumerary plantar tubercles; subarticular tubercles round, nonconical; toes bearing fleshy lateral fringes, coalescing as basal webbing; toe V partially fused to toe IV; toe disks as large as those of outer fingers, about 1.5 times width of digit proximal to disk, with well defined circumferential grooves; tip of toe III reaches base of penultimate subarticular tubercle of toe IV, that of toe V reaches distal edge of distal subarticular tubercle of toe IV; heels almost touching when flexed hindlimbs held perpendicular to sagittal plane; shank 40.0-47.4 ($\bar{x} = 43.1 \pm 1.0$) % SVL in males, 38.5-45.4 ($\bar{x} = 41.7$) % in females.

Color in ethanol. Body brown with black markings (sacral chevron, interorbital bar, inguinal bar); snout dirty cream; limb bars perpendicular on shank, narrower than interspaces; no anal triangle; side of head darker than dorsum, with vague indications of canthal-supratympanic stripe; pale markings on lip approximately defining labial bars; brown band extending from eye across tympanum; posterior surfaces of thighs brown; venter dirty cream, spotted with brown, or brown with diffuse darker reticulum.

Color in life. Dorsum brown with black spots; flanks and venter often with yellow spots bordered with dark brown; flanks and concealed limbs brown to burnt pink; throat and chest yellow in males; venter yellowish with fine black spots; iris yellow with wavy black horizontal stripe and fine black or brown reticulum (P. M. Ruiz fieldnotes, 29 Nov. 1981).

Measurements of holotype in mm. SVL 32.2, shank 13.9, HW 13.2, head length 11.2, chord of head length 12.2, upper eyelid width 2.2, IOD 3.8, tympanum length 1.3, eye length 3.1, E-N 2.8.

Natural history. *Eleutherodactylus mnionaeetes* was collected only once during a brief visit to a cloud forest on the road between Ramiriquí and Zetaquira. Of the eleven individuals found, all seven males are adults as are three of the females. The fourth female (ICN 11008) is a juvenile 21.8 mm SVL. The holotype was found under a rock in axillary amplexus with ICN 11005. Because the collectors visited the site during the day, no calling was heard that could be attributed to this species. When I revisited the site in February 1998, during the drought of El Niño, the environment was moist and not bathed in clouds but rather intense sunlight, most of the cloud forest had been cleared within 1 km of the road, and the area was being converted into pastureland and/or potato fields. Searching under rocks, logs, and in the dirt banks along the side of the road yielded a single *Bolitoglossa*. Our failure to find frogs in February 1998 was probably due to the impact of El Niño more than the activity of campesinos because the soil beneath rocks and logs was warm to the touch. Immediately to the NNE of the type-locality, cloud forests persist on the northeastern face of the cuchilla de Bijagual.

Remarks. *Eleutherodactylus mnionaeetes* exhibits the "S" condition of the mandibular ramus of the trigeminal nerve and a SQat formula for the *m. depressor mandibulae*.

Eleutherodactylus nervicus is now known from eight localities on the complex of páramos associated with Laguna Chingaza at elevations between 3000 and 3850 m. Additionally, it has been found in the Páramo de Chisacá (ICN 11869, 11871-72), Municipio de Usme, Depto. Cundinamarca, 3600 m (aprox. 4° 18'N, 74° 13'W) and in one of the páramos on the Boyacá-Cundinamarca border (MLS 1172, 8.5 km, airline, W Úmbita, Municipio de Úmbita, Depto. de Boyacá, 3450 m, aprox. 5° 13'N, 73° 32'W) (Fig. 1).

Discussion. The importance of this small frog is biogeographic because it appears to be the sister species of *E. nervicus*. As such, the suture between the distributions of this pair of species corresponds to that of two other probable pairs of sisters: *E. bogotensis*-*E. lynchii* and

Atelopus marinkelli-*A. muisca*. However, before one can conclude that a vicariance event has led to these speciation events, we need explicit hypotheses of relationships for all three pairs of species and, equally important, we need detailed mapping of the distributions of these species along the eastern edge of the Cundiboyacense altiplano, where páramo habitats are discontinuous (Fig. 1).

A further significant point about *E. mnionaeetes* and *E. nervicus* is that they appear to differ in habitat. The available data for *E. nervicus* are relatively plentiful and the species appears to be one of páramos although it does descend into the upper parts of the bosque andino. The only collection for *E. mnionaeetes* is from a site in bosque andino, suggesting that the speciation event included an ecological shift (Ross, 1972). Vicariance speciation does not predict habitat shifts whereas peripatric speciation requires it (Lynch, 1989). There is no obvious difference in habitat for the pair of *Atelopus* species nor for the other pair of *Eleutherodactylus* species.

Acknowledgments

The many courtesies of María Cristina Ardila and Pedro M. Ruiz. For companionship in the field, Angela Suárez, Jairo Sánchez, and P. M. Ruiz. For their help in securing live specimens of *E. nervicus*, Andres Acosta, Ximena Bernal, Pedro Galvis, and Horst Ludecke.

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